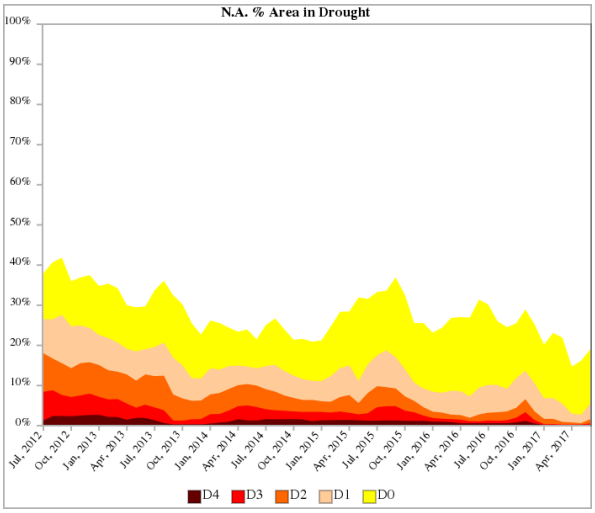
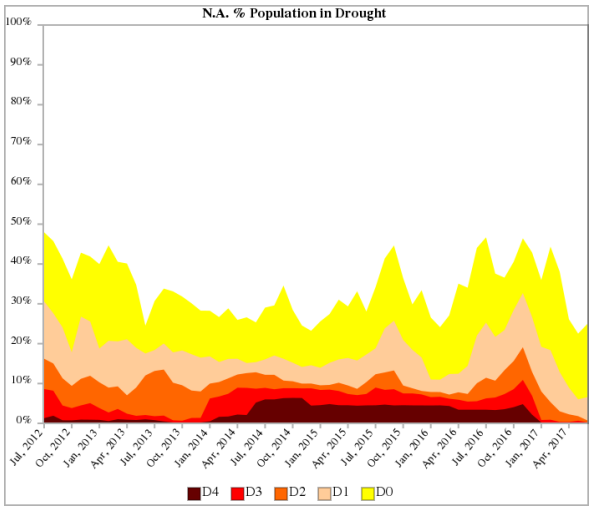
North American Drought Monitor – June 2017

At the end of June 2017, moderate to exceptional drought (D1-D4) affected approximately 5.3% of the area and 6.4% of the population of North America. The percent area value was 2.8% more than the value for the end of May 2017, and the percent population value was 0.6% more than the value for the end of May.





CANADA: Drought conditions developed extremely quickly through the past month in southern regions of the Prairies as a result of minimal rainfall and strong persistent winds. The region most significantly impacted both in severity and in extent, was southern Saskatchewan, where the total precipitation accumulation in June was below 25 mm and precipitation since April 1 below 75 mm, less than half of average. Dry conditions continued to worsen through much of British Columbia, with below normal rainfall through June. Abnormally wet conditions persisted in parts of Ontario and Quebec. Conditions in Atlantic Canada continued to improve, with only a few small Abnormally Dry (D0) pockets remaining.

Pacific Region (BC): Conditions in British Columbia degraded over the month of June. Abnormally high spring rainfall depleted quickly and short-term satellite-derived precipitation data, as well as, in situ station data indicated that both the Abnormally Dry (D0) and Moderate Drought (D1) conditions in the northeast persisted and expanded west. A D0 pocket developed in the central interior of the province following a dry couple of months that had resulted in poor soil moisture and high forest fire risk. Conditions in Haida Gwaii improved to normal as a result of above average precipitation over the past sixty days.

Prairie Region (AB, SK, MB): Dryness continued to envelop the southern agricultural regions of the Prairies throughout June, especially in southern Saskatchewan. Low precipitation accumulation in parts of southern Alberta resulted in the addition of two small D0 pockets surrounding Calgary and Pakowki Lake. Severe precipitation deficits, low soil moisture, and evaporative conditions resulted in the development of a large D1 pocket and small Severe Drought (D2) pocket in southern Saskatchewan. All weather station and satellite-derived data indicates that this region has experienced an extremely dry year, with

dryness increasing progressively further south. According the Saskatchewan Agriculture crop report for the week ended July 3, topsoil moisture province-wide on cropland is rated as five percent surplus, 49 percent adequate, 37 percent short and nine percent very short. Persistence of the dry conditions will cause significant impacts to livestock and crops. Producers reported significant impact on crop, pasture and haylands at the end of June. Some producers had reduced the size of their herds to ensure they had feed available to carry their livestock. The Abnormally Dry (D0) pocket across the southern half of the province was also expanded as far north as Saskatoon, with the exception of Moosomin and surrounding area. Southern Manitoba has also been experiencing an increasingly dry year; however satellite-derived soil moisture, crop reports and streamflow data indicate that conditions are less severe than southern Saskatchewan. The D0 pocket was extended further north and several D1 pockets developed along the US border due to extremely low precipitation since the start of the growing season. Conditions in northern Alberta improved as a result of precipitation and cool conditions; thus, the Abnormally Dry (D0) pocket in this region shrunk and the Moderate Drought (D1) pocket was removed.

Central Region (ON, QC): As the Central Region of the country continued to receive record amounts of rainfall, there was no drought concern, and conditions remained relatively static. Satellite-derived soil moisture data indicated the persistence of a small Abnormally Dry (D0) pocket along the southern Manitoba border in northwestern Ontario. D0 conditions in northern Quebec saw some improvement this month, with a small pocket along the northern Labrador border persisting. Satellite-derived precipitation data indicated that a small area in the northernmost part of the province was dry; thus, a D0 pocket was added. A small D0 pocket also developed near the New Brunswick border south of the St. Lawrence River as a result of short term precipitation deficit and poor streamflow.

Atlantic Region (NS, NB, PE, NL): Conditions in Atlantic Canada remained relatively static throughout June. Average precipitation since the start of the year resulted in the reduction of the long-term Abnormally Dry (D0) pocket in northeastern Nova Scotia. Small D0 pockets in northern Newfoundland and the Avalon Peninsula remained due to persisting precipitation deficits. Conditions in and around Cape Ray improved to normal as a result of short-term precipitation and good streamflow.

Northern Region (YT, NT): Conditions in Yukon Territory improved slightly over the month of June. Precipitation in the south east corner of the territory resulted in the improvement of Abnormally Dry (D0) conditions along the US border. A small pocket along the northern British Columbia border persisted. Satellite-derived data indicated dryness south of Mackenzie bay; thus a D0 pocket was added in the north and north east of the Yukon and Northwest Territories, respectively. Short-term precipitation deficits resulted in the persistence of the D0 pocket west of Norman Wells. Poor streamflow and low moisture indicated by the Canadian Forest Fire Weather Index Drought Code resulted in the development of a large D0 pocket around Yellowknife and south of Great Slave Lake.

UNITED STATES: An extreme, mid- to late-month heat wave gripped the West, with severe impacts—including cattle mortality and a rash of wildfires—being noted across California, the Great Basin, and the Southwest. By the end of June, year-to-date wildfires

had charred nearly 2.8 million acres (more than 1.1 million hectares—about 135% of the ten-year average and the nation's most active start to a fire season since 2011.

Periods of heat extended across the Plains, where a marked drying trend developed. The most significant agricultural effects of dryness and periods of heat were noted across eastern Montana and the Dakotas, where drought had already developed before summer arrived.

By July 2, the lowest rangeland and pasture conditions in the nation were being reported by North Dakota (63% very poor to poor), followed by South Dakota (57%) and Montana (42%). On the same date, Montana led the country in topsoil and subsoil moisture rated very short to short (80 and 77%, respectively).

Rainfall was much more abundant along the Gulf Coast and from the Mississippi Valley eastward. Tropical Storm Cindy, which moved inland near the Texas-Louisiana border on June 22, greatly contributed to the heavy rain in the Gulf Coast region, before, during, and after landfall. However, even within this wetter area from the Mississippi Valley to the Atlantic Coast, showers were lacking in portions of the Mid-Atlantic States and the Midwest.

Outside of the Western heat wave zone, periods of hot weather were fleeting and interspersed with cool spells. As a result, monthly average temperatures did not stray far from normal across large sections of the country.

Contiguous U.S. drought (D1 or worse) coverage had fallen to a U.S. Drought Monitor-era record low 4.52% on May 23, but crept back to 8.04% by June 27 on the strength of intensifying drought across the northern Plains. For a 2-week period during the first half of June, extreme drought (D3) disappeared entirely from the United States. However, with D3 development in eastern Montana and parts of the Dakota, extreme drought coverage in the contiguous U.S. rose to 0.97% by June 27. Specifically, D3 covered 25% of North Dakota, 7% of Montana, and 2% of South Dakota by late June. There has not been any exceptional drought (D4) anywhere in the U.S. since January 17, 2017.

Outside of the contiguous U.S., neither dryness nor drought was noted in Puerto Rico during June, continuing a streak that began in late-March 2017. Meanwhile in Alaska, some moderate drought (D1) developed during June across the southwestern mainland, covering 6% of the state. Farther south, Hawaii's unusually dry summer continued, with drought coverage—all on the Big Island—expanding from 25 to 34% of the state during the 4-week period ending June 27.

Historical Perspective: According to preliminary data provided by the National Centers for Environmental Information, the contiguous U.S. experienced its 20th-warmest, 56th-wettest June during the 123-year period of record. The nation's June average temperature of 70.3°F (21.3°C) was 1.9°F (1.0°C) above the 1901-2000 mean, while precipitation averaged 3.01 inches (76.5 mm), 103% of average.

Cool June weather was mostly confined to the Southeast. As a result, state temperature rankings ranged from the 17th-coolest June in Louisiana to the second-hottest June in

Arizona. The only hotter June in Arizona was noted just last year, in 2016. Top-ten rankings for June heat were also observed in California, Delaware, Nevada, and Utah.

Meanwhile, June precipitation rankings ranged from top-ten dryness in Nebraska (second driest) and Maryland (seventh driest) to top-ten wetness in Vermont and four of the five Gulf Coast States—all but Texas. The only drier June in Nebraska occurred in 1933; the only wetter June in Florida transpired in 2012.

Overall, near-record warmth and wetness dominated the country during the first half of 2017. Nationally, the January-June average temperature of 50.9°F (10.5°C) was 3.4°F (1.9°C) above the 20th century mean, behind only 52.1°F (11.2°C) in 2012. Concurrently, the average precipitation of 17.86 inches (453.6 mm) was 117% of normal, representing the nation's sixth-wettest January-June period on record—and wettest since 1998.

Agricultural and Hydrological Highlights: During June, primary agricultural drought impacts were centered across the northern Plains. According to the U.S. Department of Agriculture, North Dakota led the nation on July 2 with rangeland and pastures rated 63% very poor to poor, followed by South Dakota (57%) and Montana (42%). Not coincidentally, North Dakota had the nation's highest proportion of its hay production area in drought (D1 or worse)—82% on June 27, based on the U.S. Drought Monitor depiction—trailed by South Dakota (55%) and Montana (46%). Nationally, 11% of the hay production area was in drought on June 27, up from 5% on May 30.

Substantial drought-related impacts were also noted for a variety of row crops across the northern Plains. In fact, 44% of the nation's spring wheat production area was in drought on June 27, up sharply from 13% at the end of May. About one-third (33%) of the U.S. spring wheat crop was rated very poor to poor, according to USDA, on July 2. On that date, South Dakota's spring wheat was 65% very poor to poor. More than half (51%) of Montana's spring wheat was characterized as being in very poor to poor condition.

Among major production states, South Dakota also led on July 2 in winter wheat rated very poor to poor (63%), along with sorghum (32%), soybeans (23%), and corn (22%). Similarly, North Dakota led the nation on that date in oats (46%) and barley (24%) rated very poor to poor. Meanwhile, only 3 to 4% of the U.S. corn and soybean production areas were in drought by June 27, with little change noted during the month, as the heart of the Midwest remained largely free of drought.

By July 2, topsoil moisture was nearly depleted across portions of the northern Plains—80% very short to short in Montana, along with 68% in South Dakota. Topsoil moisture was roughly one-half very short to short in several other states on the Plains, including North Dakota (54%), Nebraska (51%), and Oklahoma (46%). Short-term dryness was noted in parts of the Mid-Atlantic States, where topsoil moisture was more than one-half very short to short in Maryland (58%) and Delaware (54%). Elsewhere, seasonal drying in the West resulted in topsoil moisture shortages in several states, such as California (65% very short to short), Utah (48%), New Mexico (48%), Washington (46%), and Wyoming (44%).

Any lingering drought in the Southeast was vanquished by June rainfall, with no drought remaining by month's end east of the Mississippi River. Florida's topsoil moisture, which had been 72% very short to short on May 28, was just 10% short (and 17% surplus) on July 2. Meanwhile, Florida's pastures were 9% very poor to poor (and 72% good to excellent) on July 2, an improvement from 60% very poor to poor on May 21.

On July 1, 2017, reservoir storage as a percent of average for the date was near or above average in all Western States except New Mexico. Low storage in New Mexico was a chronic problem, related to effects of multi-decadal drought and overtaxed water supplies. Elsewhere, California's July 1 statewide storage stood at 116% of average. California's above-average storage occurred in spite of ongoing repairs at Oroville Dam, which contained only 82% of its typical water volume for July 1. Oroville, the nation's tallest dam, was damaged by flooding in February 2017, and the lake behind it—which was partially drained—typically accounts for about one-tenth of California's total reservoir storage.

MÉXICO: Above-normal rainfall fell in central and southern Mexico in addition to the Yucatan Peninsula and the coast of Jalisco in June 2017. These rains were produced mainly by tropical storms Beatriz, Calvin and Cindy, hurricane Dora, low pressure channels and seven tropical waves. In the rest of the country, rainfall was close to below normal, with the Baja California Peninsula and Sonora without rains. At the national level, June 2017 ended as the 10th driest June, with 72.4 mm, 69.1% of normal based on the 1941-2016 records.

At the state level, June was in the top ten driest for 13 of 33 states, with San Luis Potosi recording their driest June with 24.9 m (0.98 in), almost one sixth of normal (145.2 mm or 5.7 in). Other states in the top ten driest category were Zacatecas (2nd), Hidalgo (3rd), Durango (5th), Tlaxcala (6th), Jalisco, Sinaloa and Tamaulipas (7th), Nayarit (8th), Michoacán, and Nuevo León (9th), as well as Coahuila as their tenth driest June. In contrast, only Morelos and Colima reached a wettest classification.

Due to heavy rains caused by tropical storm Beatriz from 31 May to June 2 in southern Oaxaca, the long-term moderate drought (D1) was erased. This storm brought over 516 mm (20.3 in) in the Tehuantepec Isthmus over this time. The Federal Government issued a declaration of natural disaster after this event to help the population affected by flooding and severe rains. Another moderate drought which dissipated throughout June was in the southeast of Michoacán, while in the Yucatan-Quintana Roo area, the moderate to severe drought (D1-D2) coverage was also eliminated.

On the other hand, abnormally dry conditions (D0) continued growing from west to northwest and from central to northeast Mexico. D0 state coverage included 83.9% in Sinaloa, 71.1% in Durango, 57.7% in Sonora, 53.8% in Nayarit, 46.1% in Zacatecas, 42.2% in San Luis Potosi, and 38% in Chihuahua. Moderate drought (D1) coverage also increased, mainly in Jalisco (61.3%), but severe drought (D2) reached 31.1% in Aguascalientes, 3.6% in Hidalgo, 1.3% in Queretaro, 9.6% in San Luis Potosi, 3.9% in Tamaulipas, 7.9% in Veracruz, and 0.5% in Zacatecas. As of June 30, the country coverage from moderate (D1) to severe (D2) drought increased from 3.9% to 12.2%, and the abnormally dry (D0) condition

changed from 29.8% to 37.9%, compared with the drought assessment on May 31 of this year.

The summer rainy season onset from central to southern country led to a mean temperature decline in these regions. However, the mean temperature was warmer than normal from the central to northern parts of the country, as well as some areas on the Yucatan Peninsula. The national mean temperature of 26.8 °C in June 2017 was 2.6°C above the 1981-2010 mean; this meant it was the warmest June along with June of 2013, according to records since 1971. At the state level, four states located in the drought area experienced their warmest June, which included Aguascalientes, Hidalgo, Jalisco, Querétaro and San Luis Potosí.

Furthermore, the drought condition was reflected in the surface burned by fires over the period from January 1 to July 6, 2017, where Jalisco, Chihuahua, Oaxaca, Durango, Nayarit, Guerrero, Zacatecas, Sonora, Campeche, and Michoacán were in the top ten most category of state area burned. During the first three months of the spring-summer season, there were 4.7 million hectares (11.6 million acres) planted, which meant a growth of 0.1% with respect to the previous cycle counterpart. Seventy-three percent of this area was devoted to crops, with corn, beans, sorghum, cotton and barley grain, comprising 87.3% of the total crops. Most of this planting activity was located in the states of Puebla, State of Mexico, Chiapas, Michoacán, Oaxaca, Chihuahua, and Guanajuato, which contributed to the 59.6% of the total area. On the other hand, the national livestock results were more positive. The production of bovine milk remains with a growth of 2.1%; however, there is an expectation of an increase in the international prices of milk powder, which in the medium term could encourage a production increase. The above information is according to the Agri-Food and Fisheries Information System (SIAP).